Analox XDI Sensor/Transmitter

User Manual

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1 Introduction

The Analox XDI sensors/transmitters are constructed as complete integrated units using 'state of the art' electrochemical sensors together with the necessary electronic circuits to convert the tiny electrical signals from the sensor to an industry standard 2 wire, 4-20mA output.
The sensor cell mounting is designed in such a way that cell replacement may easily be carried out simply and quickly.

Models are available for the gases and ranges shown in Table 1.

Table 1: Sensor types and ranges

Gas		Sensor	Ranges
Oxygen	O_2	Electrochemical	0-25%
Carbon Monoxide	CO	Electrochemical	0-250ppm
Hydrogen Sulphide	H_2S	Electrochemical	0-50ppm
Sulphur Dioxide	SO_2	Electrochemical	0-10ppm
Nitrogen Dioxide	NO_2	Electrochemical	0-10ppm
Hydrogen	H_2	Electrochemical	0-2000ppm
Hydrogen Cyanide	HCN	Electrochemical	0-25ppm
Nitric Oxide	NO	Electrochemical	0-100ppm
Hydrogen Chloride	HCl	Electrochemical	0-10ppm
Ammonia	NH_3	Electrochemical	0-10ppm
Ethylene Oxide	C_2H_4O	Electrochemical	0-25ppm

2 Health Warning

Sensor cells used in the XDI series contain an acid electrolyte. The sensors are shipped with the sensor cell already fitted. Replacement sensor cells are shipped in sealed packs. If there are any signs of chemical leakage from either the sensor assembly or from the replacement cells, use rubber gloves and wear chemical splash goggles to handle and clean up. Thoroughly rinse contaminated surfaces with water. Note the First Aid Procedures in Table 2 to be adopted in the event of contacting the sensor electrolyte if it accidentally leaks.

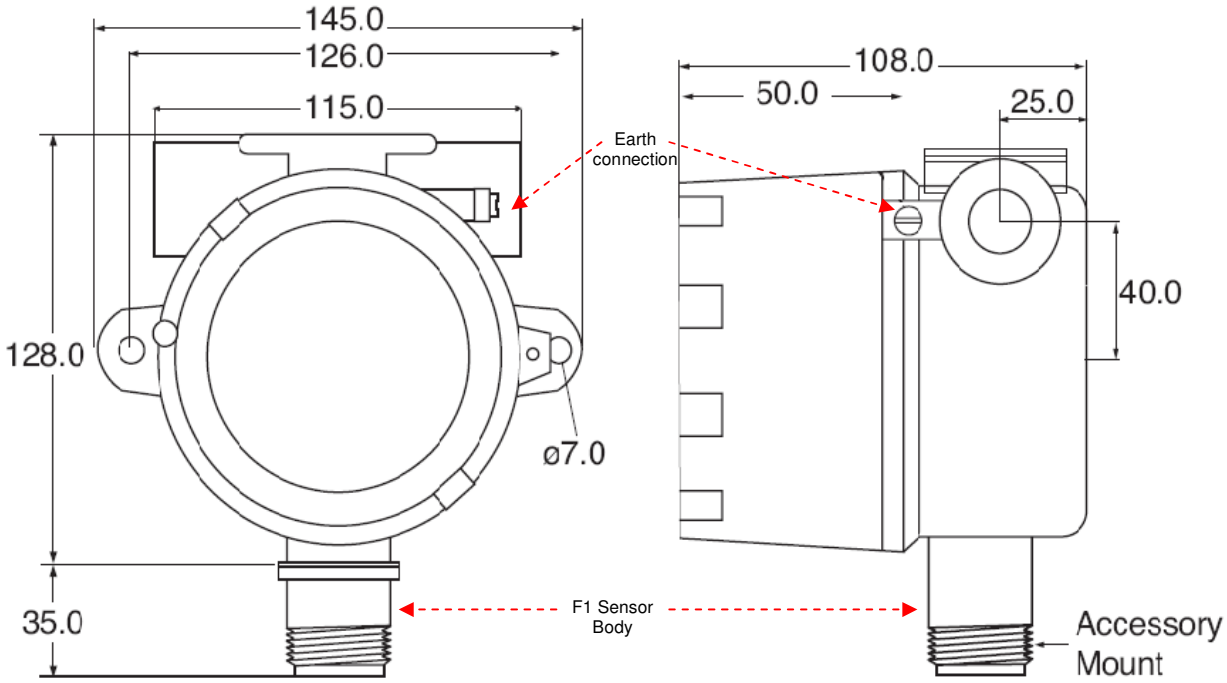
Table 2: First aid procedures

CONTACT TYPE	EFFECT	FIRST AID PROCEDURE
Skin	Acid electrolyte is corrosive. Skin contact could result in a chemical burn.	Wash the affected parts with a lot of water and remove contaminated clothing. If stinging persists get medical attention.
Ingestion	Can be harmful or FATAL if swallowed	Drink a lot of fresh water. Do not induce vomiting. Get medical attention immediately.
Eye	Contact can result in the permanent loss of sight	Get medical help immediately and continue to wash with a lot of water for at least 15 minutes

3 Installation

The enclosure must be fixed into position using the external fixing lugs provided. Under no circumstances must the enclosure be supported by way of any cable entry device. It is important that the cover is securely fitted to the body of the enclosure. The cover locking screw must be fully tightened down.

Figure 1: Sensor Dimensions and mounting detail
Note: All measurements in mm.



The enclosure is fitted with an M5 external earth connection; a suitable ring type terminal lug must be used to secure the earth conductor. The F1 sensor body mounting thread must be fully engaged into the junction box.

The sensor enclosure has 2 cable entries, 20mm 1.5mm pitch.
All cable entries should be made using suitably certified glands.
All unused gland ports should be sealed using appropriate certified stopping plugs.

4 Basic Electrical Installation

This section merely describes the basic electrical installation of the sensor.

To access the sensor internal electrical connections the enclosure lid grub screw should be loosened and the lid rotated anti-clockwise until the lid can be completely removed.

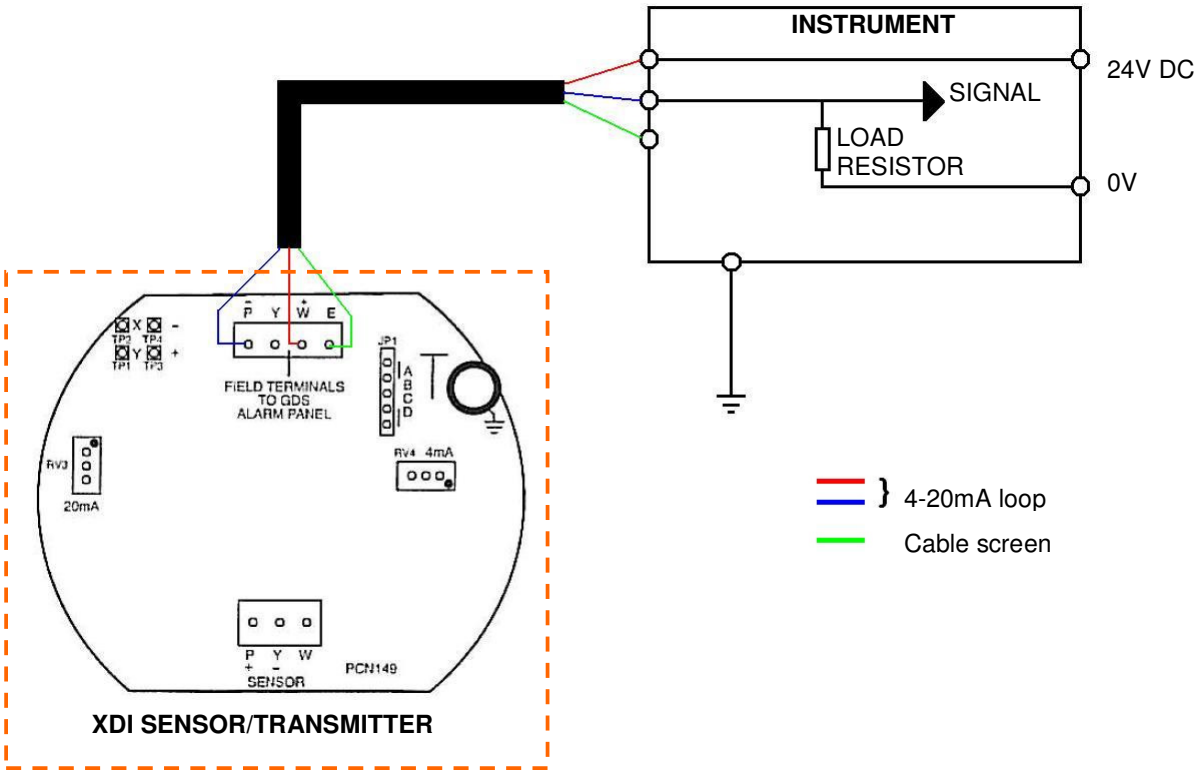
The signal cable should enter the sensor/transmitter enclosure using the cable gland. Any cable connected to the sensor/transmitter should be of the screened, twisted pair type to ensure maximum protection from any external electrical noise.

Ensure that the screen of the cable is connected to a suitable ground at only one end of the cable run (at the monitoring instrument end) to avoid unnecessary earth loops.

The internal circuit is connected to the two cores and isolated from the metal case.

Basic electrical connections are shown in Figure 2.

Figure 2: Basic electrical connections



5 Hazardous Area Installation

1 **Installation**: The enclosure must be fixed into position using the external fixing lugs provided. Under no circumstances must the enclosure be supported by way of any cable entry device. It is important that the cover is securely fitted to the body of the enclosure. The cover locking screw must be fully tightened down.

2 **Special conditions for safe use**: (x) The unit should not be used as a safety related device in accordance with directive 94/9/EC.

3 **T Ratings**: The marking on the label on the cover must comply with the ambient temperature into which the enclosure is being installed.

4 **Earthing**: The enclosure is fitted with an M5 external earth connection; a suitable ring type terminal lug must be used to secure the earth conductor. The F1 sensor body mounting thread must be fully engaged into the junction box.

5 **Maintenance**: Periodic inspection of this equipment is necessary; refer to EN 60079-17 Clause 4.3 for guidance. Inspect the sinter disc at 6 monthly intervals to ensure it is clear and dust free.

6 The enclosure is intended for use under normal industrial conditions and must not be installed in an area where extreme vibration may occur.

7 This apparatus has been produced for use in a potentially explosive atmosphere. Before it is installed you must be aware of the requirements of BSEN60079, BSEN50014 and IEC61241.

8 All unused terminals must be fully tightened down prior to making live.

9 Do not open the Junction Box or remove the F1 sensor end cap when a hazardous gas atmosphere is present.

10 Before removing the end cap of the F1 sensor disconnect the power to the apparatus and wait 3 minutes allowing the sensor elements to cool.

11 The sensor end cap must be fully screwed into the body and the lock screw firmly tightened.

12 All cable entries should be made using suitably certified glands.

13 All unused gland ports should be sealed using appropriate certified stopping plugs.

14 **Caution**: The installation of this product must be carried out by suitably trained and qualified personnel only. We will not accept responsibility for any damage, injury or any form of loss due to products not being installed or used in strict accordance with these instructions. If in doubt, please contact Analox.

15 To maintain the certification, only manufacturers supplied spare parts should be used.

See section **11 Certification** for further details of Special Conditions for Safe Use

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6 Calibration

All XDI sensor/transmitters are calibrated before leaving the factory.

If the sensor is being used with an Analox monitoring instrument then routine calibration may be carried out using the 'ZERO' and 'CAL' or 'SPAN' controls on the instrument. The same procedure applies to any other instrument which has similar adjustment available. If it is required to check or adjust the sensor/transmitter output current then the following calibration procedure should be performed.

It should be noted that if during calibration it is not possible to achieve a satisfactory 'SPAN' adjustment then it is probable that the sensor cell has reached the end of its useful life and should be replaced. Refer to the sensor cell replacement Section.

6.1 Calibration Equipment Requirements

The following items will be required to calibrate the sensor.

- Flow Adapter
- Inert gas (eg Nitrogen or clean air)
- Certified Span gas

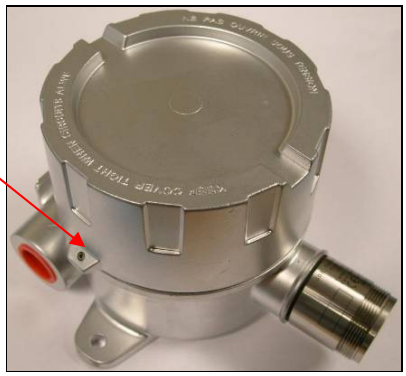
(Note: Air cannot be used for oxygen sensors).

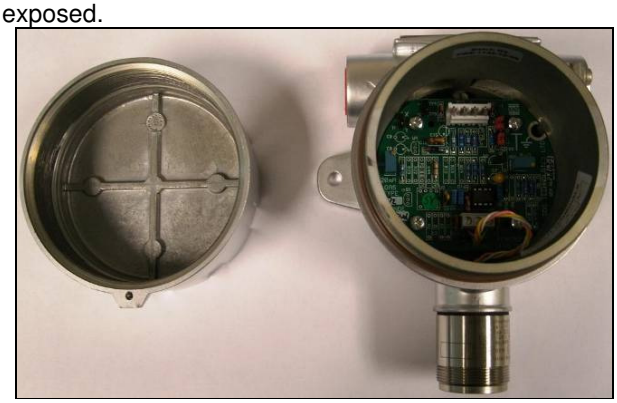
The Span Gas is specific to the sensor being calibrated and of a concentration as near as possible to the range in which most measurements are to be made. For example, in the case of the Oxygen sensor/transmitter the range of the sensor is 25% O2, so a suitable span gas would typically be in the range 20-25% O2.

6.2 Calibration procedure

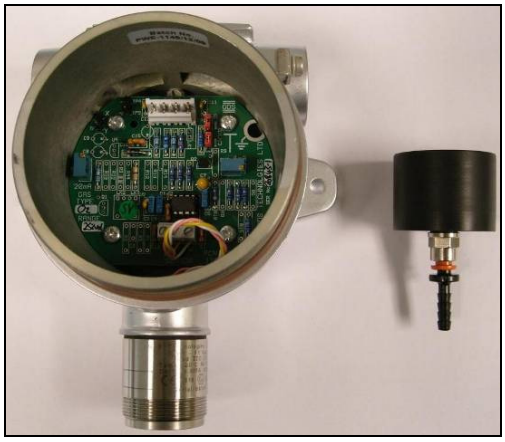
1) Loosen the lid grub screw and rotate the lid anti-clockwise until the lid can be completely removed and the internal electronics exposed.

Grub Screw



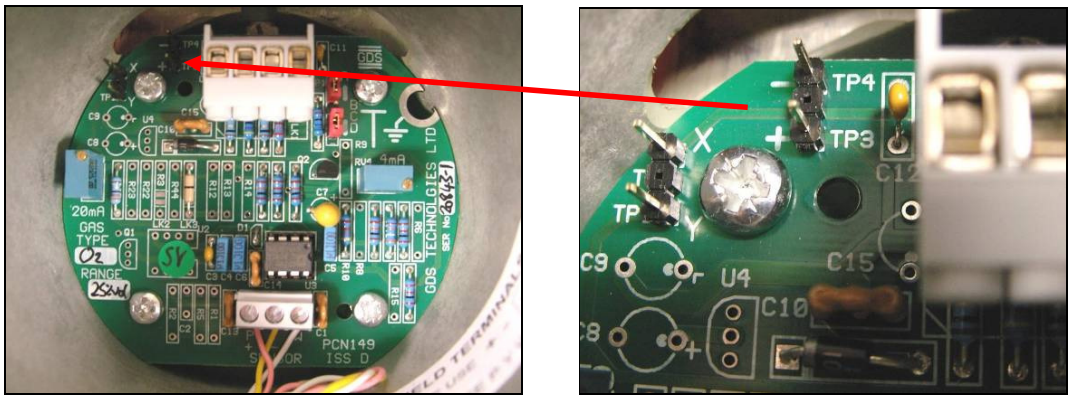


2) Fit the calibration adaptor to the sensor head.

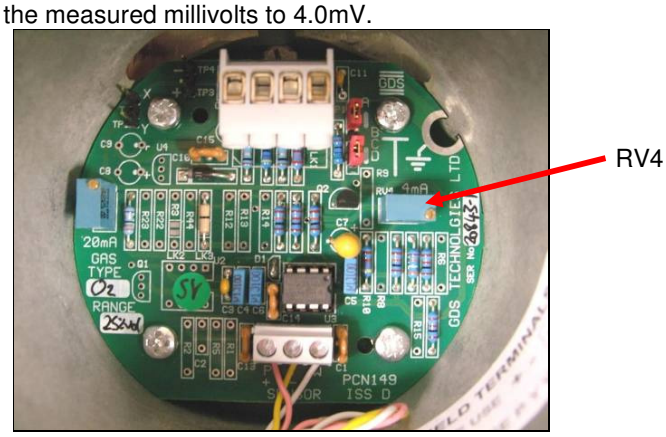


3) Purge the sensor with zero gas. Adjust the flow rate to between 150 and 300ml/min and wait about 5 minutes or until the reading is stable.

4) Connect a multi-meter set to measure millivolts (mV) betweenTP3 (+ve) and TP4 (-ve). The measured millivolt reading is the corresponding reading for the milliamp (mA) output of the sensor/transmitter.



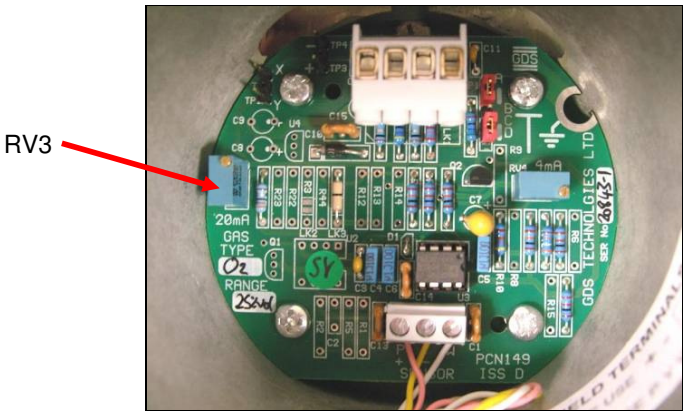
5) Adjust RV4 to set the measured millivolts to 4.0mV.



6) Purge the sensor with span gas. Adjust the flow rate to between 150 and 300ml/min and wait about 5 minutes or until the reading is stable.

7) Connect a multi-meter set to measure millivolts (mV) betweenTP3 (+ve) and TP4 (-ve).

8) Adjust RV3 until the measured millivolts agrees with the known concentration of the test gas (Refer to Example below).



Example
Assume a sensor has a range of 25% and that a Span Gas of 22% O2 concentration is to be used. The span current expected is calculated using the formula:

Span Current = **{(16 x Gas concentration) / Sensor range)} + 4** mA

= {(16 x 22) / 25)} + 4 mA

= **18.08 mA**

9) Stop the gas flow and remove the calibration adaptor.

10) Refit the lid and tighten the grub screw.

7 Sensor Cell Replacement

The expected operating life of most cells is varies. However, if the cell is constantly exposed to high doses of its specific gas, or gases to which it is cross sensitive then its life span will be reduced in proportion to the concentration/exposure time. It is a matter for the user to decide whether the cell is replaced automatically at a pre-determined interval, or if it is left until a time when it is no longer possible to calibrate. This will depend on the nature of the application.

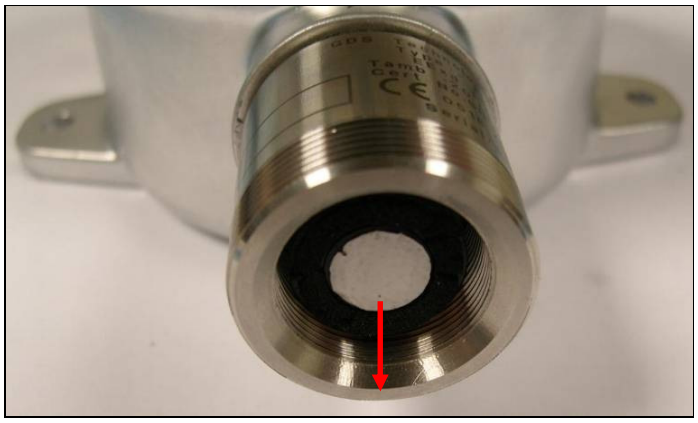
7.1 Sensor Cell Replacement Procedure

1) Isolate the sensor from its loop power supply and wait 3 minutes before proceeding to allow any power stored in the sensor to dissipate.

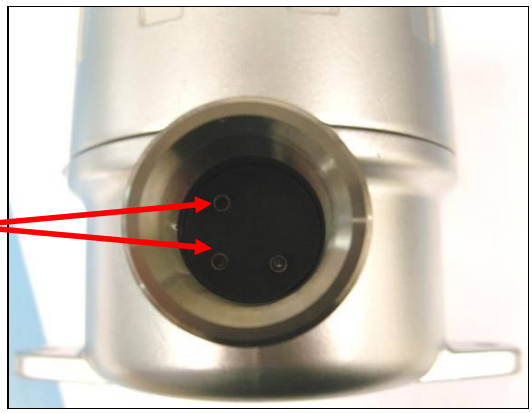
2) Remove the sensor head grub screw using a 1mm Allen key.

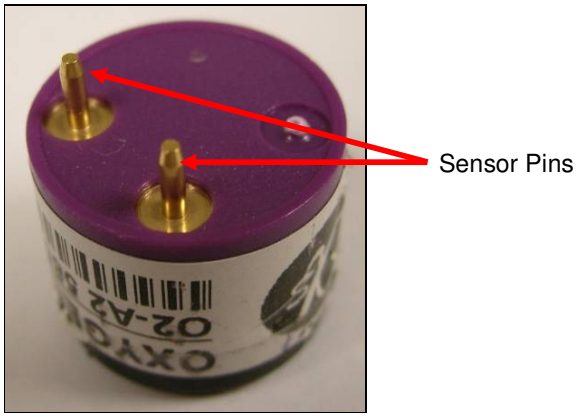
3) Unscrew the sensor head cap.

4) Remove the old cell by gently pulling it from the housing.



5) Fit the new cell into the housing. Note the orientation of the sensor connector pins and housing connector sockets, the cell can only be fitted in the correct orientation.





6) Refit the sensor head cap.

7) Refit the sensor head grub screw.

8) Re-apply power to the sensor. Allow approximately one hour for the new cell to settle and then carry out the calibration procedure.

7.2 Disposal of Discarded Cell

When the life of the sensor has expired or it is leaking or otherwise damaged it must be disposed of safely in accordance with local regulations.

8 Disposal of Electrical and Electronic Equipment

According to WEEE regulation this electronic product can not be placed in household waste bins. Please check local regulations for information on the disposal of electronic products in your area.

9 Specifications

Sensor Ranges	Gas	Response time (secs)	Expected Cell operating life*
	0-25% Oxygen	$T_{90} < 15$	2 Years in Air
	0-250ppm Carbon Monoxide	$T_{90} < 30$	2 Years in Air
	0-50ppm Hydrogen Sulphide	$T_{90} < 25$	2 Years in Air
	0-10ppm Sulphur Dioxide	$T_{90} < 25$	2 Years in Air
	0-10ppm Nitrogen Dioxide	$T_{90} < 40$	2 Years in Air
	0-2000ppm Hydrogen	$T_{90} < 90$	2 Years in Air
	0-25ppm Hydrogen Cyanide	$T_{90} < 200$	2 Years in Air
	0-100ppm Nitric Oxide	$T_{90} < 45$	2 Years in Air
	0-10ppm Hydrogen Chloride	$T_{90} < 70$	2 Years in Air
	0-100ppm Ammonia	$T_{90} < 60$	2 Years in Air
	0-25ppm Ethylene Oxide	$T_{90} < 120$	2 Years in Air
Sensor Type	Electrochemical		
Classification	Certified flameproof ATEX / IECEx – Exd IIC T6 Gb CSA/US Class 1 Groups A, B, C, D		
ATEX SCS Cert No	03ATEX1176X		
CSA/US Cert No	LR115863-1		
IECEx SCS Cert No	IECEx SIRO6.0016X		
UK Design patent	No. 2025396		
Housing Material	Stainless Steel 316 S16		
Weight	0.165 kg		
Cable Exit Mounting Thread	20mm 1.5mm pitch		
Accessory Mounting Thread	33mm 1.25mm pitch		
Lock Screw	3mm-1mm key		
Ingress Protection	IP63		
Approved sensor junction box	Type XDI – EExd IIC T6 Material – aluminium alloy		

*If the cell is constantly exposed to high doses of its specific gas, or gases to which it is cross sensitive then its life span will be reduced in proportion to the concentration/exposure time

10 Replacement Cells/Accessories

The following Replacement Cells/Accessories are available for the XDI series of sensors:

Replacement Cells

Part Number	Description
9100-0410	0-25% Oxygen
9100-0420	0-250ppm Carbon Monoxide
9100-0430	0-50ppm Hydrogen Sulphide
9100-0440	0-10ppm Sulphur Dioxide
9100-0450	0-10ppm Nitrogen Dioxide
9100-0460	0-2000ppm Hydrogen
9100-0480	0-25ppm Hydrogen Cyanide
9100-0490	0-100ppm Nitric Oxide
9100-0500	0-10ppm Hydrogen Chloride
9100-0510	0-100ppm Ammonia
9100-0530	0-25ppm Ethylene Oxide

Accessories

Part Number	Description
6000-0045	Spare 20mm Port Plug EExd Stopping Plug
6000-0048	F1 Flow Adaptor

11 Certification

sira CERTIFICATION

1 **EC TYPE-EXAMINATION CERTIFICATE**

2 Equipment intended for use in Potentially Explosive Atmospheres Directive 94/9/EC

3 Certificate Number: **Sira 03ATEX1176X** Issue: **4**

4 Equipment: **F1 Gas Sensor**

5 Applicant: **GDS Technologies Limited**

6 Address: Fusion Point
Ash Lane
Garforth
Leeds
LS25 2GA
UK

7 This equipment and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

8 Sira Certification Service, notified body number 0518 in accordance with Article 9 of Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in the confidential reports listed in Section 14.2.

9 Compliance with the Essential Health and Safety Requirements, with the exception of those listed in the schedule to this certificate, has been assured by compliance with the following documents:

EN 60079-0:2006 EN 60079-1:2007 EN 61241-1:2004

10 If the sign 'X' is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

11 This EC type-examination certificate relates only to the design and construction of the specified equipment. If applicable, further requirements of this Directive apply to the manufacture and supply of this equipment.

12 The marking of the equipment shall include the following:

II 2 G D
Ex d IIC T6 Gb -20°C≤Ta≤+35°C
Ex tb IIIC T85°C Db IP6X
Ex d IIC T5 Gb -20°C≤Ta≤+50°C
Ex tb IIIC T100°C Db IP6X
Ex d IIC T4 Gb -20°C≤Ta≤+85°C
Ex tb IIIC T135°C Db IP6X
Ex d IIC T3 Gb -20°C≤Ta≤+120°C
Ex tb IIIC T200°C Db IP6X

Project Number 20978
C. Index 14

D R Stubbings BA MIET
Certification Manager

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Sira Certification Service
Rake Lane, Eccleston, Chester, CH4 9JN, England
Tel: +44 (0) 1244 670900
Fax: +44 (0) 1244 681330

sira CERTIFICATION

SCHEDULE

EC TYPE-EXAMINATION CERTIFICATE **Sira 03ATEX1176X**
Issue 4

13 **DESCRIPTION OF EQUIPMENT**

The F1 Gas Sensor is designed to monitor flammable gases in air. It is cylindrical in shape and has a two-part construction comprising a main body and an end cap, both of which are manufactured from stainless steel. The end cap screws into the main body and has a 250 µm sinter fused into its walls. This sinter allows the surrounding atmosphere to enter the sensor so that the presence of the flammable gas can be detected by various sensing elements contained within the main body. The sensor has a maximum power dissipation of 2.48 W. The rear end of the main body is filled with a setting compound through which the equipment wiring passes, it also has a male M20 x 1.5 thread-form that allows the F1 Gas Sensor to be fitted to an associated enclosure.

Variation 1 - This variation introduced the following change:

i. The introduction of minor dimensional changes relating to the gas sensor extended body.

Variation 2 - This variation introduced the following change:

i. The change of the Applicant's address from Swillington Lane, Swillington, Leeds, LS26 6BZ to Fusion Point, Ash Lane, Garforth, Leeds, LS25 2GA.

Variation 3 - This variation introduced the following change:

i. Following appropriate re-assessment to demonstrate compliance with the requirements of the EN 60079 series of standards, the documents originally listed in section 9, EN 50014:1997 (amendments 1 and 2), EN 50018:2000 and EN 50281-1-1:1998, were replaced by those currently listed, the markings in section 12 were updated accordingly.

Variation 4 - This variation introduced the following change:

i. The recognition of previously assessed updated drawings.

14 **DESCRIPTIVE DOCUMENTS**

14.1 **Drawings**

Refer to Certificate Annexe.

14.2 **Associated Sira Reports and Certificate History**

Issue	Date	Report No.	Comment
0	24 October 2003	R51A8269A	The release of the prime certificate.
1	19 January 2006	R51A14236A	The introduction of Variation 1.
2	9 December 2008	R51L19300A	This Issue covers the following changes: • All previously issued certification was rationalised into a single certificate, Issue 2, Issues 0 to 1 referenced above are only intended to reflect the history of the previous certification and have not been issued as documents in this format. • The introduction of Variation 2.
3	30 December 2008	R51L19028A	The introduction of Variation 3.
4	18 September 2009	R20978A	The introduction of Variation 4.

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sira CERTIFICATION

SCHEDULE

EC TYPE-EXAMINATION CERTIFICATE

Sira 03ATEX1176X
Issue 4

15 **SPECIAL CONDITIONS FOR SAFE USE** (denoted by X after the certificate number)

15.1 The F1 Gas Sensor shall not be used as Safety Related Devices in accordance with Directive 94/9/EC.

15.2 When installed, the F1 Gas Sensor shall be electrically bonded to earth.

15.3 Mechanical and explosion protection shall be provided for the flying leads of the F1 Gas Sensor.

16 **ESSENTIAL HEALTH AND SAFETY REQUIREMENTS OF ANNEX II** (EHSRs)

The relevant EHSRs that are not addressed by the standards listed in this certificate have been identified and individually assessed in the reports listed in Section 14.2.

17 **CONDITIONS OF CERTIFICATION**

17.1 The use of this certificate is subject to the Regulations Applicable to Holders of Sira Certificates.

17.2 Holders of EC type-examination certificates are required to comply with the production control requirements defined in Article 8 of directive 94/9/EC.

17.3 The manufacturer shall substitute, on the approved label affixed to the apparatus, the new name and address for the old name and address.

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Physical Technical Testing Institute

Ostrava-Radvanice

(1) # Supplement No. 1 to EC-Type Examination Certificate

(2) **Equipment or Protective Systems Intended for use in Potentially Explosive Atmospheres Directive 94/9/EC**

(3) EC-Type Examination Certificate Number:

FTZÚ 06 ATEX 0296X

(4) Equipment or protective system: **XD1 & XD1win + F1 Gas sensor**

(5) Manufacturer: **GDS Technologies Ltd.**

(6) Address: **Unit 1 Fusion Point Ash Lane Garforth Leeds LS25 2GA, England**

(7) This supplement of certificate is valid for: - modification of certified apparatus

(8) Modification of certified apparatus (protective system) and any of its approved variants are specified in documentation, a list of which is mentioned in the schedule of this certificate.

(9) This supplement to type examination certificate is valid only for type examination of design and construction of product sample in accordance with Annex 3 Paragraph 6) of Directive No. 94/9/EC. The Directive contains other requirement which the manufacturer shall fulfil before products are placed on the market or introduce in service.

(10) Safety requirements of modified parts were fulfilled by satisfying the following standards:

EN 60079-0:2006; EN 60079-1:2007; EN 61241-0:2006; EN 61241-1:2004;

(11) Marking of equipment shall contain symbols:

II 2GD Ex d tD A21 IIC T6-T3 T85°C

(12) This type examination certificate is valid until: **31.01.2012**

Responsible person:

Dipl. Ing. Šindler Jaroslav
Head of certification body

PHYSICAL-TECHNICAL TESTING INSTITUTE FYZIKÁLNĚ TECHNICKÝ ZKUŠEBNÍ ÚSTAV FTZÚ Ex AO 210 NB 1026

Date of issue: 25.09.2008

Number of pages: 2
Page: 1/2

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Physical Technical Testing Institute
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(13) **Schedule**

(14) **Supplement No. 1 to**
EC-Type Examination Certificate N° FTZÚ 06 ATEX 0296X

(15) Description of Equipment or Protective System:
The Gas sensor XDI+F1 is possible to use in temperature range up to +120°C.

(16) Report No. : 06/0296, annex on pages 6 and 12

(17) Special conditions for safe use:

17.1	Tamb:	-20°C to + 35°C	for temperature class T6
		-20°C to + 50°C	for temperature class T5
		-20°C to + 85°C	for temperature class T4
		-20°C to + 120°C	for temperature class T3

17.2 The water shield is necessary to use for IP 64 protection.

(18) Essential Health and Safety Requirements:
The conditions, mentioned in the main document apply to the whole range.

(19) Documentation:
GDS technology Ltd. confirms that the construction of the XDI+F1 gas sensor has not undergone any change since certification of the model Dated 20 June 2008

Responsible person:

Dipl. Ing. Šindler Jaroslav
Head of certification body

PHYSICAL-TECHNICAL TESTING INSTITUTE FYZIKÁLNĚ TECHNICKÝ ZKUŠEBNÍ ÚSTAV FTZÚ Ex AO 210 NB 1026

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